

Detecting, Modelling and Responding to Effusive Eruptions

The Geological Society of London
Books Editorial Committee

Chief Editor

RICK LAW (USA)

Society Books Editors

JIM GRIFFITHS (UK)

DAVE HODGSON (UK)

PHIL LEAT (UK)

NICK RICHARDSON (UK)

DANIELA SCHMIDT (UK)

RANDELL STEPHENSON (UK)

ROB STRACHAN (UK)

MARK WHITEMAN (UK)

Society Books Advisors

GHULAM BHAT (India)

MARIE-FRANÇOISE BRUNET (France)

ANNE-CHRISTINE DA SILVA (Belgium)

JASPER KNIGHT (South Africa)

MARIO PARISE (Italy)

SATISH-KUMAR (Japan)

VIRGINIA TOY (New Zealand)

MARCO VECOLI (Saudi Arabia)

IAVCEI/GSL publishing agreement

This volume is published under an agreement between the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) and the Geological Society of London and was endorsed and co-edited by members of the IAVCEI Remote Sensing Commission.

GSL is the publisher of choice for books arising from IAVCEI meetings and IAVCEI receives a fee for all books published under this agreement.

Books published under this agreement are subject to the Society's standard rigorous proposal and manuscript review procedures.

It is recommended that reference to all or part of this book should be made in one of the following ways:

HARRIS, A. J. L., DE GROEVE, T., GAREL, F., & CARN, S. A. (eds) 2016. *Detecting, Modelling and Responding to Effusive Eruptions*. Geological Society, London, Special Publications, **426**.

PATRICK, M. R., KAUAHIKAUA, J., ORR, T., DAVIES, A. & RAMSEY, M. 2016. Operational thermal remote sensing and lava flow monitoring at the Hawaiian Volcano Observatory. *In*: HARRIS, A. J. L., DE GROEVE, T., GAREL, F., & CARN, S. A. (eds) 2016. *Detecting, Modelling and Responding to Effusive Eruptions*. Geological Society, London, Special Publications, **426**, 489–503. First published online August 6, 2015, <http://doi.org/10.1144/SP426.17>

GEOLOGICAL SOCIETY SPECIAL PUBLICATION NO. 426

Detecting, Modelling and Responding to Effusive Eruptions

EDITED BY

A. J. L. HARRIS

Université Blaise Pascal, France

T. DE GROEVE

Joint Research Centre of the European Commission, Italy

F. GAREL

Université de Montpellier, France

and

S. A. CARN

Michigan Technological University, USA

2016

Published by
The Geological Society
London

THE GEOLOGICAL SOCIETY

The Geological Society of London (GSL) was founded in 1807. It is the oldest national geological society in the world and the largest in Europe. It was incorporated under Royal Charter in 1825 and is Registered Charity 210161.

The Society is the UK national learned and professional society for geology with a worldwide Fellowship (FGS) of over 10 000. The Society has the power to confer Chartered status on suitably qualified Fellows, and about 2000 of the Fellowship carry the title (CGeol). Chartered Geologists may also obtain the equivalent European title, European Geologist (EurGeol). One fifth of the Society's fellowship resides outside the UK. To find out more about the Society, log on to www.geolsoc.org.uk.

The Geological Society Publishing House (Bath, UK) produces the Society's international journals and books, and acts as European distributor for selected publications of the American Association of Petroleum Geologists (AAPG), the Indonesian Petroleum Association (IPA), the Geological Society of America (GSA), the Society for Sedimentary Geology (SEPM) and the Geologists' Association (GA). Joint marketing agreements ensure that GSL Fellows may purchase these societies' publications at a discount. The Society's online bookshop (accessible from www.geolsoc.org.uk) offers secure book purchasing with your credit or debit card.

To find out about joining the Society and benefiting from substantial discounts on publications of GSL and other societies worldwide, consult www.geolsoc.org.uk, or contact the Fellowship Department at: The Geological Society, Burlington House, Piccadilly, London W1J 0BG: Tel. +44 (0)20 7434 9944; Fax +44 (0)20 7439 8975; E-mail: enquiries@geolsoc.org.uk.

For information about the Society's meetings, consult *Events* on www.geolsoc.org.uk. To find out more about the Society's Corporate Affiliates Scheme, write to enquiries@geolsoc.org.uk.

Published by The Geological Society from:

The Geological Society Publishing House, Unit 7, Brassmill Enterprise Centre, Brassmill Lane, Bath BA1 3JN, UK

The Lyell Collection: www.lyellcollection.org

Online bookshop: www.geolsoc.org.uk/bookshop

Orders: Tel. +44 (0)1225 445046, Fax +44 (0)1225 442836

The publishers make no representation, express or implied, with regard to the accuracy of the information contained in this book and cannot accept any legal responsibility for any errors or omissions that may be made.

© The Geological Society of London 2016. No reproduction, copy or transmission of all or part of this publication may be made without the prior written permission of the publisher. In the UK, users may clear copying permissions and make payment to The Copyright Licensing Agency Ltd, Saffron House, 6–10 Kirby Street, London EC1N 8TS UK, and in the USA to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, USA. Other countries may have a local reproduction rights agency for such payments. Full information on the Society's permissions policy can be found at: www.geolsoc.org.uk/permissions

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library.

ISBN 978-1-86239-736-1

ISSN 0305-8719

Distributors

For details of international agents and distributors see:

www.geolsoc.org.uk/agentsdistributors

Typeset by Nova Techset Private Limited, Bengaluru & Chennai, India

Printed and bound by CPI Group (UK) Ltd, Croydon CR0 4YY

Acknowledgements

Preparation of this book was supported by Labex CLERVOLC (Clermont-Ferrand Centre for Volcano Research: <http://clervolc.univ-bpclermont.fr/>) who funded collation of the directories for operational satellite-based hot spot detection and lava flow simulation capabilities; as well as the implementation of the GIS test (as reported in the concluding Chapters and their Appendices). Labex CLERVOLC also funded a science proof reader who completed all final manuscript checks; where we

are extremely grateful to Fran van Wyk de Vries for her thorough, meticulous, professional and efficient work. Likewise, we thank the hard work of all reviewers, whose thorough reviews ensured that not only is this contribution as complete as-is possible, but also of a high, peer-reviewed standard. Finally, we thank Serge Gélabert for kindly making available the cover photo used in this publication. This is CLERVOLC publication 187.